A KEY FOR THE IDENTIFICATION OF INDIAN GENERA OF FAMILY MEGACHILIDAE (HYMENOPTERA : APOIDEA)[1]

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(With fifteen text-figures)

The Indian megachilid bees comprise about 150 species, grouped under 23 generic categories. A consolidated key for the identification of 34 genera of Megachilidae, including the Indian species is presented for the first time. Most of the characters enumerated in this key are illustrated with figures.

The family Megachilidae (subfamily Megachilinae Schenck, 1859, Jahrb. ver. Naturk. Nassau XIV: 19) was first differentiated to its present status by Schmiedeknecht (1886) and included the genera *Megachile, Lithurgus, Osmia, Heriades* and *Anthidium*. Earlier Smith (1853, 1854) had described numerous Indian species of the present day Megachilidae, housed at the British Museum. Recognition of subfamily status to Megachilinae was also forwarded by Dalla Torre (1894), under the family head of Apidae.

Since then, several new megachilid species have been described or recategorised under different genera. For example the majority of species formerly placed under *Apis, Andrena, Anthophora* etc. have been shifted to *Megachile, Heriades* and *Osmia* etc., during the early years of this century.

The first compilation of megachilid fauna of the Indian region was presented by Bingham (1897). His 'Apidae' included *Coelioxys, Heriades, Thaumatosoma, Anthidium, Megachile, Lithurgus, Osmia, Stelis* and *Parevaspis,* a total nine genera of present day Megachilidae. Among them *Stelis* and *Thaumatosoma* were described from beyond the present Indian territories. Later Michener (1965) reduced *Thaumatosoma* Smith (1865) to the rank of subgenus under the genus *Chalicodoma* Lepeletier.

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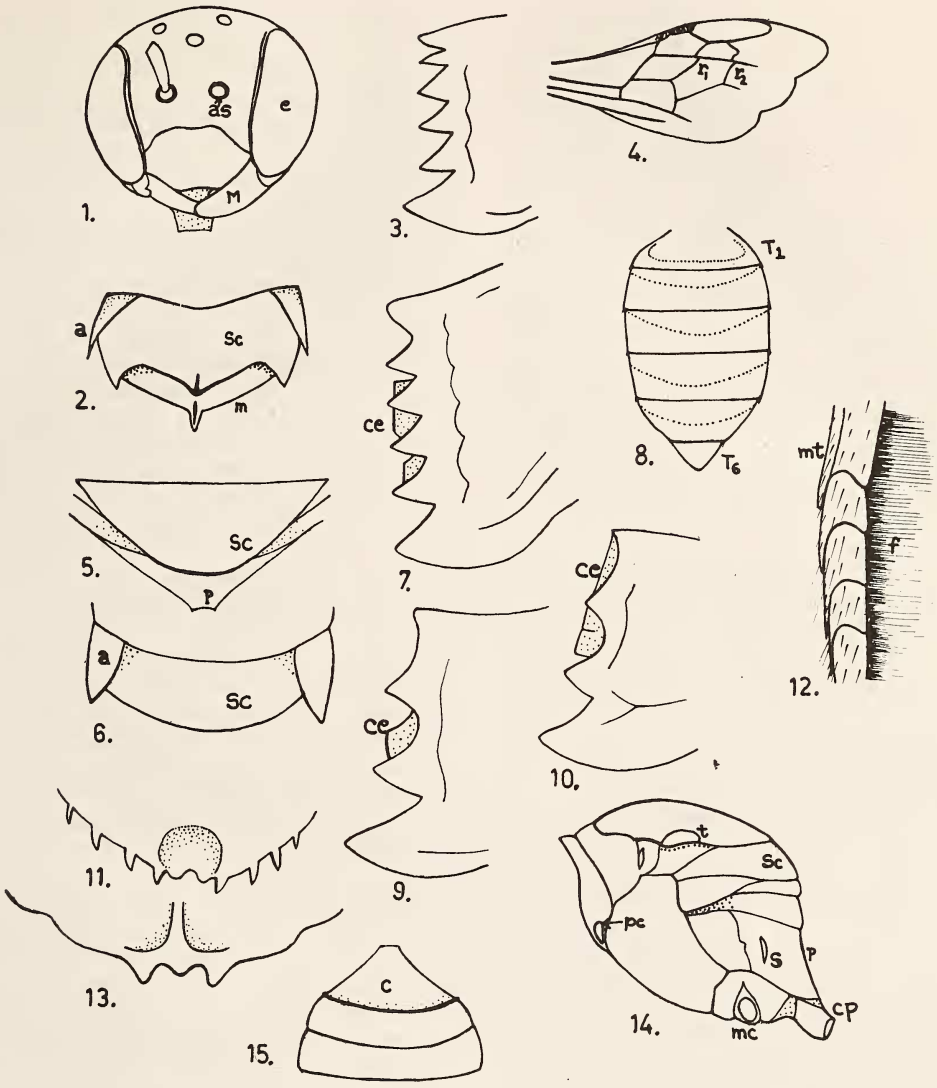
Batra (1977) presented a key to the genera of Apoidea while describing the bio-ecology and management of some species of Indian bees. She added three more genera, *Chalicodoma, Anthocopa* and *Anthidiellum*, to the family Megachilidae (of Bingham 1897). The key presented was primarily concerned with the field identification of 35 bee genera, and included *Megachile* and *Chalicodoma* at the same rank. Some characters were also given for the identification of *Stelis* and *Parevaspis.*

Except these two papers, no further publication leading up to the level of genera of Indian Megachilidae is available.

The diagnostic characters of the family Megachilidae are: Fore wing with two submarginal or cuboital cells, both recurrent veins ending in or at base and apex of second cuboital cell (sometimes beyond as in *Anthidium*); pollen collecting scopa only in females and restricted from 2nd to 5th or 6th sternal plates (scopa absent in parasitic and Anthidinii genera); subantennal sutures directed towards the outer edges of antennal sockets (sutures are completely absent in Lithurginii); most of the female leaf-cutters with a clear bevelled cutting edge in the dentate margin of their mandibles, whereas resin users and cleptoparasites lack them; 3rd and 4th segments of labial palpi much smaller than 1st and 2nd and angulated from the basal two segments: larvae spin tough cocoons before pupation; apart from the cleptoparasites, many of the megachilids are highly restricted in their infrafloral relationship and thus oligolecty is a rela-



Figs. 1-15. Diagnostic characters for some genera of family Megachilidae.
1. *Lithurgus*: head, front view; 2. *Dioxys:* axillae, scutellum and metanotum (dorsal view); 3. Dentate margin in female mandible of *Anthidium*; 4. Forewing of *Paranthidium;* 5. *Parevaspis*: scutellum, metanotum and propodeum (dorsal view); 6. *Coelioxys*: axillae and scutellum (dorsal view); 7. Dentate margin of female mandible of *Creightonella*; 8. *Chalicodoma*: female metasoma in dorsal view; 9. Dentate margin of female mandible of *Eumegachile;* 10. Dentate margin of mandible of female *Megachile;* 11. Tergum 6th carnia in dorsal view of male *Megachile*; 12. Modification of front tarsi in male *Megachiloides*; 13. *Robertsonella*: produced apical truncation of clypeus; 14. Lateral view of generalised mesosoma (except wings and legs) in *osminii*, 15. *Heriades*: first tergal concavity margin carina in dorsal view.

Abbreviations: a-axilla; as-antennal socket; c-concavity; ce-cutting edge; cp-posterior coxa; mt-metatarsus; p-propodeum; pc-forecoxa; r_1 & r_2 - recurrent veins; s-spiracle; sc-scutellum; t-tegula; T_1 & T_6 - tergum first & sixth.

tively common phenomenon in this group.

Around 150 species of Megachilidae have so far been reported from India. They are grouped according to the most recent classification, within 23 genera. This paper deals with 34 genera, 12 of these have not yet been reported from India, but occur in the neighbouring countries, and are likely to occur in India. Furthermore, they reflect strikingly contrasting characters with those of paired Indian genera, and are therefore keyed along with Indian genera. *Aglaoapis* Cameron (1901, type-species: *A. brevipennis* Cam. 1901. Entomologist p. 262, from Bombay) and *Wainia* Tkalcu (1980, type-species: *W. lonavlae* Tkalcu 1980. *Annotnes. Zool. Bot. Bralislava 135:* 1-20) have not been listed in this key.

KEY TO THE GENERA OF MEGACHILIDAE

1. Pygidial area well developed in male, in female represented by a short spine; jugal lobe in posterior wing about 3/4th as long as vannal lobe; vestibule reaching up to mid-mesosomal segment; hind tibiae coarsely or finely spiculate dorsally ..... *Lithurgus** Latreille
— Pygidial area absent in both sexes; jugal lobe of posterior wing less than half as long as vannal lobe; vestibule not so long; hind tibiae not spiculate 2
2. Body surface, especially metasomal terga, usually ornamented with pale integumental maculations; claws of female cleft or at least with an inner or subapical teeth; stigma short, its inner margin not much longer than its width 3
— Body surface other than legs never so maculated; claws of female simple or at most with basal angles or teeth; stigma elongate 13
3. Metanotum with a median spine; axillae produced to angles; second submarginal cell shorter than first; first transverse cuboital cell transverse to wing; scopa absent ..... *Dioxys* Lepel. & Serville
— Metanotum simple; axillae rounded posteriorly; second submarginal cell usually as long as first; first transverse cuboital oblique; scopa present or absent 4
4. Scopa absent; mandible in male black, or if maculated, then clypeus black, at least in part 5
— Scopa usually present; mandible in male yellow, maculated, and clypeus entirely yellow 6
5. Margin of scutellum somewhat protuberant; propodeum completely vertical, without a dorsal pitted area ..... *Heterostelis* Timberlake
— Margin of scutellum not at all protuberant; propodeum with a narrow but distinct dorsal pitted area ..... *Stelis** Panzer
6. Arolia absent; mandible of female with 5 or more close set, conical teeth 7
— Arolia present; mandible of female with not more than four teeth 8
7. Seventh abdominal tergum of female with a large median emargination; second recurrent vein distad of second transverse cuboital by several vein widths ..... *Callanthidium* Cockerell
— Seventh abdominal tergum of female without a median emargination: second recurrent vein not so much distad of second transverse cuboital ..... *Anthidium** Fabricius
8. Hind margin of scutellum produced to form a carinate and broadly truncated tip, overhanging most of the propodeum; subantennal sutures more or less strongly arcuate outward, especially below ..... *Anthidiellum** Cockerell
— Hind margin of scutellum not so produced and rounded; subantennal sutures straight 9
9. Posterior lobe of pronotum with its carina greatly expanded forward forming a lamella, extending along anterior border or mesoscutum; each posterior coxa toothed, largest in males ..... *Dianthidium* Cockerell
— Posterior lobe of pronotum not so broadly expanded, if carinate, anterior margin of carina restricted behind anterior margin of mesoscutum; posterior coxae not toothed; 8th abdominal tergum of male more or less modified with processes or a shallow emargination 10
10. Body not maculated, in ours complete metasoma brick red or black; a sharp carina separates the anterior and lateral faces of mesepisterna, scutellum produced back, overhanging full propodeum; scopa in female absent ..... *Parevaspis** Ritsema
— Abdominal terga partly or fully maculated with yellow or ivory bands which may be entire or interrupted 11
11. Second recurrent vein received considerably beyond apex of 2nd submarginal cell; abdominal yellow bands submedian, interrupted medially, not strongly narrowed towards mid-line; ocelli extremely small, mandible of female terminating in long oblique margin ..... *Paranthidium* Cockerell & Cockll
— Second recurrent vein received within or very near to apex of second submarginal cell; mandible of female tridentate, with not so strongly oblique apex 12
12. Abdominal terga with entire or nearly entire, transverse, apical or sub-apical, yellow or mostly

ivory bands; ocelli relatively large; maxillar palpi 3 – segmented ..... *Heteranthidium* Cockerell

— Body entirely black, except for clypeus and paraocular areas of male; maxillary palpi 5-segmented ..... *Trachusa* Panzer

13. Arolia absent; 6th tergum of male with a strongly elevated preapical ridge which is frequently toothed, notched or sometimes transformed into long transversely arranged spines; 7th tergum of male hidden or largely so 14

— Arolia present: 6th tergum of male without such a preapical ridge, the spines, teeth or notches, if present, usually at apical margin; 7th tergum more often exposed, but sometimes hidden 24

14. Axillae produced back to conspicuous spine; usually midscutellum with a carinate transverse ridge, separating anterior and distinctly angulate posterior surfaces of scutellum; apex of metasoma pointed or spatulate in female or with tergal spines, produced apically in male, scopa absent ..... *Coelioxys** Latreille

— Axillae not produced, often rounded posteriorly; scutellum convex or posteriorly rounded in profile; apex of metasoma in female not attenuate; and in male such prominently produced spines usually absent; scopa present 15

15. Mandibles of female with 5 or 6 almost equally spaced teeth, with incomplete cutting edges in 2nd to 4th interspaces; males with at least 5 or 6 exposed sternites ..... *Creightonella** Cockerell

— Mandible of females with 3, 4 or 5 dents, cutting edges not as above, males with no more than 4 exposed metasomal sternites 16

16. Sternum 6 of female chiefly bare, at least apical half lacks scopal hairs, but with a straight row of short, subapical bristles and a bare apical lip; mid-tibial spur in males absent or greatly reduced ..... *Pseudocentron** Mitchell

— Sternum 6 of female with a well clothed surface of scopal hairs or without a bare apical lip; mid-tibial spur in males well developed, in a few species suppressed or even absent, where basitarsi is much modified 17

17. Form usually narrow and elongate, metasoma parallel sided in males, terga strongly transversely convex in females; female mandible with, at the most, an incomplete cutting edge in 2nd interspace or lacking it also; in males sternum 4 is usually retracted, if exposed then mandible lacks any basal, ventral or submedian process 18

— Form broad, metasoma more cordate or ovoid in females; terga more flattened transversely; sternum 4 always exposed in males 19

18. Female mandible 4-dentate, with cutting edge in 2nd interspace, if cutting edge absent then clypeus much modified; in males tridentate with a distinct process, but if process absent then mandible much elongate and obscurely 4-dentate; sternum 8 finely setose at apical lobe in Indian species ... *Eumegachile** Friese

— Female mandible lacks any cutting edge, either broad with 4 low vestigial teeth or with a sub-basal tooth, otherwise long and slender with 3 more or less distinct apical teeth; ventral process lacking in males; sternum 8 fringed at the margins of apical lobe ..... *Chalicodoma* Lepeletier

19. Female mandible with 4 or 5 teeth, without cutting edges; inferior margin of male mandible usually with a process in Indian species; front coxae of males with distinct spines; form rather short with metasoma cordate ..... *Chrysosarus** Mitchell

— Mandible of females 3, 4, or 5-dentate, with a cutting edge at least in the innermost interspace; front coxae may or may not bear spines; ventral process of male mandible may or may not be present 20

20. Mandible of female 4-dentate, inner angle blunt or truncate, 3rd tooth acute or obtuse, but 2nd interspace much wider and usually with a distinct cutting edge; male mandible without a distinct ventral process; front tarsi may or may not be modified ..... *Cressoniella** Mitchell

— Mandible of female 3, 4 or 5-dentate, inner angle acute, second interspace often very narrow in those that are 4-dentate, with only a vestigial cutting edge; male mandible with a well developed ventral, basal process; front trasi often broadly dilated and brightly coloured 21

21. Males 22

— Females 23

22. Transverse carina of 6th tergum lacks a median emargination, in profile its upper surface is straight or slightly convex from base to apex of carina; margin of carina often crenulate or multispinose; apical margin of 6th tergum beneath carina, with a pair of acute lateral teeth and an inner pair of more carinate teeth ..... *Megachiloides** Mitchell

— Transverse carina of 6th tergum flexed upward, surface forming an angle with the basal area of plate, usually with a definite median emargination but obscured by more lateral spines; lateral or inner teeth of apical margin, beneath carina very small or absent ..... *Megachile** Latreille

23. Tergum 6th nearly or quite straight in profile; mandible 3-dentate, with only two well defined teeth near apex, 3rd tooth vestigial or absent, inner angle acute, a long cutting edge filling 2nd interspace; *or* apex of

sternum 6 thickened or produced above an apical fringe of short hairs; *or* mandible distinctly 4-dentate, 2nd interspace very small, inner angle acute .... *Megachiloides** Mitchell

— Tergum 6 concave in profile, towards apex; mandible 4 or 5-dentate; apex of sternum 6 not as above; if mandible 4-dentate, inner angle either truncate or blunt, or 2nd interspace more pronounced, usually with a short cutting edge ..... *Megachile** Latreille

24. Thorax elongate, scutellum medially feebly convex in profile; metanotum convex and constitutes dorsal surface of thorax; propodeum with distinct horizontal base; shortest distance between tegulae usually but only slightly, greater than length of scutum; pterostigma broader than distance from inner edge of prestigma to costal margin of wing and longer than prestigma 25

— Thorax short, scutellum strongly convex in profile; metanotum flattened or convex, on posterior declivity of thorax; propodeum ordinarily entirely declivous; shortest distance between tegulae greater than length of scutum; pterostigma broader as above, but often as short as prestigma 30

25. Basal concavity of matasoma not at all carinate; second tergum with quite shallow concavity; posterior lobes of pronotum incarinate 26

— Basal concavity of metasoma with a carinate or subcarinate rim; second tergum with a deep or shallow concavity mid-basally; posterior lobes or margin of pronotum strongly carinate 35

26. First recurrent vein nearly or almost completely interstitial with first submarginal; shortest distance between tegulae is considerably greater than length of mesoscutum ..... *Formicapis* Sladen

— First recurrent vein considerably far from the base of first submarginal; shortest distance between tegulae little, if any, greater than length of mesoscutum ... 27

27. Suture between mesepisternite and metepisternite straight in long median portion; scutellar surface oblique and medioposteriorly protuberant, metanotum slightly suppressed below the scutellar projection from dorsal view; clypeal truncation produced apically and overhead beyond the labral base in female; face below antennae in male covered with short, fine, appressed pubescence ..... *Robertsonella** Titus

— Suture between mesepisternite and metepisternite arcuate; scutellar surface broadly but strongly convex; metanotum constitutes posterior declivity in continuation with scutellar margin; apical margin of female clypeus not so much produced, merely reaches up to labrum base; subantennal area of male with long pubescence 28

28. Six metasomal terga exposed in male; clypeus of female very short and broad, produced into a slender median apical horn ..... *Chelostomopsis* Cockerell

— Seven metasomal terga exposed in male; female clypeus not much modified 29

29. Posterior coxae each with a longitudinal carina on inner ventral angle; labial palpi with third segment flattened and connate with second, into one small cylindrical segment ..... *Chelostoma** Latreille

— Posterior coxae incarinate; labial palpi with third segment cylindrical, similar to fourth .... *Prochelostoma* Robertson

30. Anterior and lateral faces of mesepisternite separated by a weak carina in between; second tergum with broad shining transverse concavity; seventh tergum of male quadridentate; brownish black, small bees .... *Ashmeadiella** Cockerell

— Mesepisternite carina absent, slight abrupt change in sculpture differentiate either faces; second tergum shallowly concave or merely sulcate 31

31. Parapsidial lines punctiform, or short oval, at most three times as long as broad; seventh tergum of male without tooth at either side on apical margin; always metallic forms 32

— Parapsidial lines linear; seventh tergum in male with teeth on apical margin, two on either side of median line; rarely metallic 33

32. Posterior coxae with longitudinal carina on inner ventral angle; parapsidial lines slightly elongate; propodeal carina arched slightly ..... *Diceratosmia* Robertson

— Posterior coxae incarinate; parapsidial lines puncti form; propodeal carina straight ..... *Osmia** Panzer

33. Body usually elongate; second tergum with basally flat or convex area, except median longitudinal sulcus, not separated from horizontal dorsal surface by a line or carina, except sometimes along the distance across the sulcus 34

— Body short and robust; basal area of second tergum broadly and shallowly concave, almost always separated from dorsal surface by transverse impressed line or feebly developed carina .... *Anthocopa** Lepeletier & Serville

34. Posterior coxae carinate at inner ventral angle; proboscis short, galeae and first two labial palpi segments furnished with numerous strong hairs, apices of which are hooked or wavy ..... *Proteriades* Titus

— Posterior coxae not so carinate, rarely with an impunctate line replacing the carina; probosc is long, without unusual hairs ..... *Hoplitis* Klug

35. Basal tergal concavity margin strongly carinate; second tergite with distinct transverse basal con-

cavity; axillae may or may not be produced posteriorly; scutellum sharply carinate midtransversely; apices of mid tibiae on its outer margin normal; body in general coarsely punctured ..... *Heriades** Spinola

— Basal tergal concavity margin mid-dorsally carinate; second tergum without baso-median concavity; axillae rounded posteriorly, minute; scutellum mid-transversely broadly convex and angulated with the rest of posterior surface; apices of mid tibiae on its outer margin prominently produced, almost dentate; body in general not so coarsely punctured ... . *Eriades** Spinola

*Genera whose species are recorded from India.

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